

WHAT IS CLAIMED IS:

1. A method for forming a barrier metal of a semiconductor device, comprising:

5 forming an insulating layer on a semiconductor substrate and forming an opening in the insulating layer;

forming a TiSiN layer having a desired thickness by repeatedly performing a process of forming a TiSiN layer having an atomic layer thickness, which performs deposition of a SiH₄ 10 layer inside the opening and on the insulating layer using an atomic layer deposition process and performs deposition of a certain precursor layer on the SiH₄ layer; and

15 performing plasma processing for the TiSiN layer so as to remove impurities contained in the TiSiN layer.

15

2. The method of claim 1, wherein an Si layer is deposited, instead of the SiH₄ layer.

20 3. The method of claim 1, wherein the SiH₄ layer is deposited using an SiH₄ gas.

4. The method of claim 2, wherein the Si layer is deposited using an SiH₄ gas.

25 5. The method of claim 1, wherein the precursor layer is

formed by any one of a Tetrakis DiMethyl Amido Titanium (TDMAT) layer, a Tetrakis DiEthyl Amido Titanium (TDEAT) layer and a $TiCl_4$ layer.

5 6. The method of claim 2, wherein the precursor layer is formed by any one of a Tetrakis DiMethyl Amido Titanium (TDMAT) layer, a Tetrakis DiEthyl Amido Titanium (TDEAT) layer and a $TiCl_4$ layer.

10 7. The method of claim 3, wherein the precursor layer is formed by any one of a Tetrakis DiMethyl Amido Titanium (TDMAT) layer, a Tetrakis DiEthyl Amido Titanium (TDEAT) layer and a $TiCl_4$ layer.

15 8. The method of claim 4, wherein the precursor layer is formed by any one of a Tetrakis DiMethyl Amido Titanium (TDMAT) layer, a Tetrakis DiEthyl Amido Titanium (TDEAT) layer and a $TiCl_4$ layer.

20 9. The method of claim 5, wherein the $TiSiN$ layer having the atomic layer thickness is formed by reacting the precursor layer by thermal decomposition at a temperature ranging from 350 to 450°C.

25 10. The method of claim 6, wherein the $TiSiN$ layer having

the atomic layer thickness is formed by reacting the precursor layer by thermal decomposition at a temperature ranging from 350 to 450°C.

5 11. The method of claim 7, wherein the TiSiN layer having the atomic layer thickness is formed by reacting the precursor layer by thermal decomposition at a temperature ranging from 350 to 450°C.

10 12. The method of claim 8, wherein the TiSiN layer having the atomic layer thickness is formed by reacting the precursor layer by thermal decomposition at a temperature ranging from 350 to 450°C.

15 13. The method of claim 1, wherein the TiSiN layer is plasma processed so as to remove CH based impurities contained in the TiSiN layer.

14. The method of claim 13, wherein the TiSiN layer is
20 plasma processed under any one atmosphere of a nitrogen gas and a hydrogen gas, or an ammonia gas.

15. The method of claim 1, wherein the opening is formed into any one of a contact hole and a via hole.